

## A REVISION OF THE GENUS *SIPHONOSOMA* (SIPUNCULA)

Edward B. Cutler and Norma J. Cutler

*Abstract.*—The sipunculan genus *Siphonosoma* (Spengel, 1912) is critically reviewed as the result of an examination of all existing type-specimens. The rationale for the separation into three subgenera is considered and found to be insupportable; the subgenera are discarded. Each of the 22 nominate species is considered: ten remain as valid species, nine are reduced to junior synonyms, two are considered *incertae sedis* and one *species inquirendum*. The genus is redefined, the geographic distribution of the ten species is given and a key to these species is presented.

---

Fisher (1950:805) divided the genus *Siphonosoma* into three subgenera which he said were "fairly natural." It is not clear how he determined this naturalness but he used the presence/absence of transverse dissepiments and numerous rectal caecae to create his three groups. He did not give any rationale for selecting these characters in this or subsequent papers.

The spelling of one subgenus, *Dasmosiphon*, was incorrectly changed to *Damosiphon* in Stephen and Edmonds (1972), and that incorrect spelling has been used by a few authors. In Stephen and Edmonds (1972) *S. hataii* was submerged under *S. carolinense*, *S. billitonense* under *S. edule*, and *S. formosum* under *S. cumanense*. The three species remaining in this subgenus were given considerable attention and in Cutler and Cutler (1979) *S. carolinense* was submerged under *S. cumanense*. Cutler, Cutler, and Nishikawa (in press) propose that *S. edule* and *S. cumanense* are conspecific. Cutler (in press) petitioned the International Commission on Zoological Nomenclature that, since *S. edule* and *S. cumanense* are conspecific, the junior name, *S. cumanense*, be conserved because it is the most widely used and better known. Therefore, this subgenus now has one species, *S. cumanense*.

The subgenus *Hesperosiphon* had three species assigned to it by Fisher (1950). A new species, *S. marchadi* Stephen, 1960, was added and *S. crassum* has been synonymized with *S. vastum* (Stephen and Edmonds, 1972). The similarities between *S. vastum* and *S. parvum* are striking as noted by Stephen and Edmonds (1972:57) but they retained three species. The subgenus *Siphonosoma* (*sensu stricto*) has 16 species assigned to it in Stephen and Edmonds (1972, five of these known only from a holotype).

Of the two characters selected by Fisher (1950) when he erected the subgenera, one (transverse dissepiments) has been analysed in a large localized population of *S. cumanense* from the Malagasy Republic. It was concluded that these thin, fragile sheets of tissue are ephemeral and inconsistently present, "this is probably the most variable of the variables in these worms" (Cutler and Cutler 1979:948). It should not be used for species characterization, much less for a subgenus. The second character, many rectal caecae, is not a "natural" character if that implies wide occurrence in the phylum; it is rare and probably of minor phylogenetic

Table 1.—Proposed status of species in this article.

Former status	Proposed status
Subgenus <i>Dasmosiphon</i>	
<i>Siphonosoma carolinense</i>	<i>Siphonosoma cumanense</i>
<i>Siphonosoma cumanense</i>	<i>Siphonosoma cumanense</i>
<i>Siphonosoma edule</i>	<i>Siphonosoma cumanense</i>
Subgenus <i>Hesperosiphon</i>	
<i>Siphonosoma marchadi</i>	<i>Siphonosoma cumanense</i>
<i>Siphonosoma parvum</i>	<i>Siphonosoma vastum</i>
<i>Siphonosoma vastum</i>	<i>Siphonosoma vastum</i>
Subgenus <i>Siphonosoma</i>	
<i>Siphonosoma amamiense</i>	<i>Siphonosoma funafuti</i>
<i>Siphonosoma arcassonense</i>	<i>Siphonosoma arcassonense</i>
<i>Siphonosoma australe</i>	<i>Siphonosoma australe</i>
<i>Siphonosoma boholense</i>	<i>Siphonosoma boholense</i>
<i>Siphonosoma bonhourei</i>	<i>incertae sedis</i>
<i>Siphonosoma dayi</i>	<i>Siphonosoma dayi</i>
<i>Siphonosoma eniwetoki</i>	<i>Siphonosoma rotumanum</i>
<i>Siphonosoma funafuti</i>	<i>Siphonosoma funafuti</i>
<i>Siphonosoma ingens</i>	<i>Siphonosoma ingens</i>
<i>Siphonosoma joubini</i>	<i>incertae sedis</i>
<i>Siphonosoma mourense</i>	<i>Siphonosoma mourense</i>
<i>Siphonosoma novaepommeraniae</i>	<i>Siphonosoma cumanense</i>
<i>Siphonosoma pellucidum</i>	<i>species inquirendum</i>
<i>Siphonosoma pescadolense</i>	<i>Siphonosoma australe takatsukii</i>
<i>Siphonosoma rotumanum</i>	<i>Siphonosoma rotumanum</i>
<i>Siphonosoma takatsukii</i>	<i>Siphonosoma australe takatsukii</i>

significance as judged by outgroup comparison. As a substitute we considered using a primitive character occurring in other families i.e., contractile vessel villi, as an indicator of related species within this genus, but are not proposing any action at this time. However, we do propose returning to the concept of a genus with no subgenera, now containing ten species.

In this paper we first comment on all the species considered valid in Stephen and Edmonds (1972) in the order used therein. The literature references in this part include only original findings (not review or repeat references). We will then redefine the genus and present a key to the retained species. Our conclusions are summarized in Table 1.

*Two troublesome morphological characters.*—The term “hook” has been applied to a variety of epidermal structures in this phylum. Within this genus there exists an unusual range of structures. At one end of the continuum we find five species with nothing but secretory papillae on the introvert (*S. boholense*, *S. cumanense*, *S. funafuti*, *S. ingens*, and *S. mourense*). At the other end are two species with typical, standard, large, pointed hooks (*S. australe* and *S. vastum*) (Fig. 1C). *Siphonosoma dayi* and *S. arcassonense* have rings of chitinized tubular, scalelike papillae which lie flat along the introvert but are arranged like, and are probably homologous to, hooks (Fig. 1A & B). *Siphonosoma rotumanum* has short, not sharply pointed hooks closely associated with a large papillum (Fig. 1D).



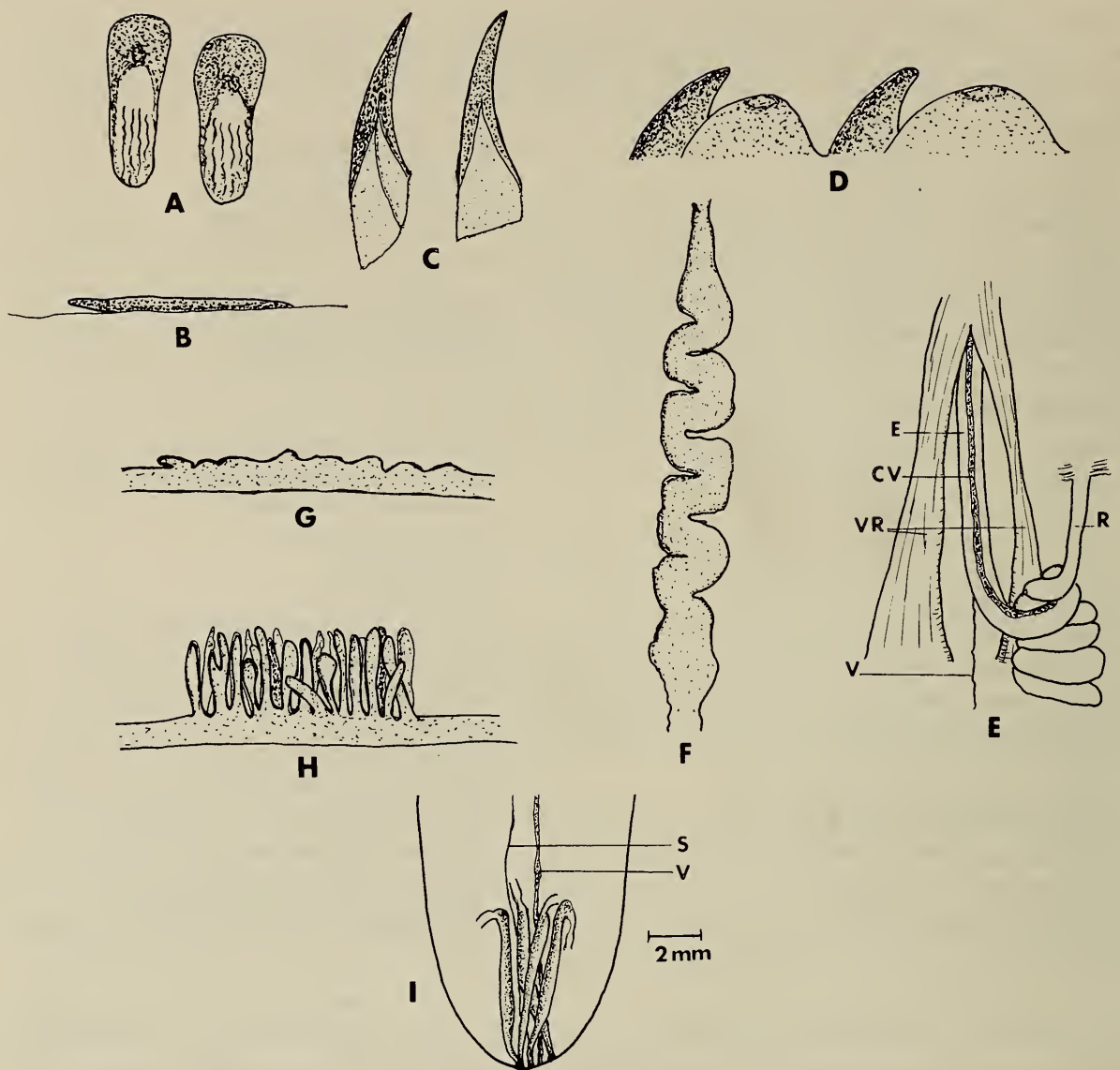


Fig. 1A-H. Hooks and contractile vessel of several *Siphonosoma* species to show variations present within this genus (see text for discussion): A, *S. dayi*, scale-like hooks viewed from above; B, *S. dayi*, hooks, side view, length ranges from 0.13–0.17 mm; C, *S. australe*, hooks, height 0.19–0.21 mm; D, *S. rotumanum*, hooks and associated papillae, height of hooks 0.1–0.2 mm; E, Ventral retractor muscles (VR), digestive system and contractile vessel (CV) to show position of latter vessel (V—ventral nerve cord; R—rectum; E—esophagus); F, Dorsal view of contractile vessel as it sometimes appears in contracted state with accordion pleats or folds; G, Side view of contractile vessel as it sometimes appears with bulbous swellings, bumps, or vesicles; H, Side view of contractile vessel with true villi as in *S. cumanense*. I, *Siphonosoma ingens*, internal posterior end of trunk showing the tubular, fusiform glandular bodies which are also present in *S. arcassonense*, (S—spindle muscle; V—ventral nerve cord.)

Another character which requires careful examination and a clear understanding of terms is the contractile vessel villi (Fig. 1E). The tubular contractile vessel may be folded like a compressed accordion (Fig. 1F) or have bulbous pouches or vesicles (Fig. 1G) along some portion of it but these are not villi. Villi are generally digitiform or clavate with a small diameter, and the length clearly exceeds the width. They are outgrowths from, not swellings of, the underlying vessel (Fig. 1H).

*Siphonosoma* (Spengel, 1912)

*Definition (revised).*—Species usually of large size (greater than 5 cm in length as adults) with introvert much shorter than trunk. Introvert with papillae and sometimes also hooks arranged in rings. Body wall with coelomic extensions (sacs); longitudinal muscle layer gathered into bands. Oral disk bears tentacles arranged around the mouth (nuchal tentacles lacking). Four retractor muscles. Contractile vessel with or without villi. Spindle muscle attached posteriorly (sometimes with three roots anteriorly). Two nephridia. A single taxon no longer separated into subgenera.

## Critical Review of Species

*Siphonosoma (Dasmosiphon) carolinense* Fischer, 1928

*Siphonosoma carolinense* Fischer, 1928:138–140.—Nishikawa, 1977:11, fig. 1. *Siphonosoma hataii* Sato, 1935:305–308, pl. 3, fig. 7, text-figs. 3–7; 1939:373.

*Material examined.*—Sendai: Sato's type of *S. hataii* (Palau 3)

Fischer's material cannot be located but in Cutler and Cutler (1979:946–948) this species was relegated to the status of a junior synonym of *S. cumanense*. The presumed difference in number of tentacles was demonstrated to be a false dichotomy. We reaffirm that earlier conclusion.

*Siphonosoma (Dasmosiphon) cumanense* (Keferstein, 1867)

(See Stephen and Edmonds (1972) for synonymy prior to 1965)

Murina, 1967:1338; 1981:14–15.—Christie and Cutler, 1974:109.—Cutler, 1977:138, fig. 1.—Gibbs, 1978:85.—Cutler and Cutler, 1979:946–949.—Edmonds, 1980:14–15, fig. 28.

*Material examined.*—Amsterdam: Sluiter's type of *Sipunculus claviger* (V. Si. 168/6). Berlin: Grube's type of *S. cumanense* var. *semirugosus*, Selenka *et al.*'s types of *S. cumanense* var. *vitreus* and *opacus*. Hamburg: *S. cumanense opacus* (V2059) & *vitreus* (V2051) determined by Fischer. Sendai: Sato's types of *S. formosum* (#6), *S. koreae* (#13), and *S. hataii* (Palau 3). Several hundred recently collected specimens from the Indian and Pacific Oceans.

This common and morphologically plastic species has a long and convoluted history in sipunculan literature. The most recent analysis of its variability is in Cutler and Cutler (1979:946–949).

Based on recent Japanese collections Cutler, Cutler, and Nishikawa (in press) conclude that it is conspecific with *S. edule*. The core of the argument is that as a worm grows its introvert increases in length more slowly than the trunk so that in large worms the introvert becomes proportionally shorter; *S. edule* is at one end of a continuum but not a separate entity. Rather than submerge the more common junior synonym, however, Cutler (in press) has petitioned the ICZN to conserve *S. cumanense* and suppress *S. edule*.

*Siphonosoma (Dasmosiphon) edule* (Pallas, 1774)

*Lumbricus edulis* Pallas, 1774:10–12.

*Sipunculus edulis.*—Sluiter, 1882:148–150, pl. 1, figs. 1 and 10; pl. 2, fig. 4, pl. 3,



fig. 1; 1886:484; 1891:122; 1902:5.—Selenka & deMan, 1883:107–108.—Shipley, 1899:157–158.—Lanchester, 1905:29.

*Siphonosoma edule*.—Sato, 1939:371–373, pl. 20, fig. 6.—Halder, 1975:58.

*Sipunculus billitonensis* Sluiter, 1886:487–488, pl. 3, figs. 1–2; 1891:123; 1902:4–5.—Shipley, 1899:157, pl. 18, figs. 6–7; 1902:135.—Lanchester, 1905:30.

*Siphonosoma billitonense*.—Stephen, 1941:402.

*Material examined*.—Edinburgh: Stephen's specimens from Maldive Islands (1958.23.104). Amsterdam: Sluiter's type of *S. billitonense* (V. Si. 168/1).

The status of this species has been examined elsewhere (Cutler and Cutler 1979; Cutler, Cutler, and Nishikawa, in press) and here we restate that it is conspecific with *S. cumanense*. The presumed difference (a shorter introvert) has been demonstrated to be attributable to large size and allometric growth. A petition to suppress this senior synonym and conserve *S. cumanense* has been filed with the ICZN (Cutler, in press).

*Siphonosoma (Hesperosiphon) marchadi* Stephen, 1960

*Siphonosoma marchadi* Stephen, 1960:515–516.

*Material examined*.—Paris: Stephen's type-material (V-33).

This species was described on the basis of two incomplete specimens. Stephen made a critical error by confusing the rectum with the esophagus. When the type-material was examined it became evident that "Rectum with numerous long villi" is really the contractile vessel with villi and "The anterior portion of the esophagus bears a large diverticulum" is rather the rectal caecum.

Therefore, this is not related to *S. vastum* as was asserted but in all ways is comparable to *S. cumanense*. We propose that the name *S. marchadi* be submerged as a junior synonym of *S. cumanense*.

*Siphonosoma (Hesperosiphon) parvum* Fischer, 1928

*Siphonosoma parvum* Fischer, 1928:141–143, figs. 1–2.

*Material examined*.—None.

This single worm could not be located and is assumed to be lost. Its uniqueness has been questioned but no formal action proposed. Its separate status rests on a presumed difference from *S. vastum* in the size and number of rectal caecae. No actual counts or measurements were given; it was stated only that they were larger and less numerous in *S. parvum*. Our experience shows that such structures do exhibit variation within a population and this seems a clear case of an artificial dichotomy within a geographically contiguous population. Therefore, we herein consider *S. parvum* to be a junior synonym of *S. vastum*.

*Siphonosoma (Hesperosiphon) vastum*  
(Selenka, De Man and Bulow, 1883)

*Sipunculus vastus* (Selenka *et al.*, 1883:103–104, pl. 12, fig. 171, pl. 13, fig. 179.—Shipley, 1898:469; 1899:158; 1902:136.—Augener, 1903:315–317.—Fischer, 1919:279; 1927:200.

*Siphonosoma vastus*.—Wesenberg-Lund, 1937:2–5, figs. 1–2.

*Siphonosoma vastum*.—Edmonds, 1955:92–95, figs. 8–9.—Cutler & Cutler, 1979: 949.—Edmonds, 1980:15–16, fig. 31.—Murina, 1981:15–16.

*Siphonosoma crassum* Spengel in Fischer, 1919:279; 1927:199.

*Material examined*.—Berlin: Selenka's type #918, 2 spec. from Jaluit, Marshall Islands; from Mozambique #279, 1 spec. Copenhagen: Wesenberg-Lund's 2 specimens from Indonesia.

The two type-specimens have dried out but the third worm is in good condition and matches the description. As pointed out in the section on *S. parvum*, we consider these two species to be conspecific. As this is the older name, it remains the valid senior synonym.

*Siphonosoma (Siphonosoma) amamiense* (Ikeda, 1904)

*Sipunculus amamiense* Ikeda, 1904:36–38, figs. 64–65; 1924:31.

*Siphonosoma amamiense*.—Sato, 1939:371.—Cutler and Cutler, 1981:57–58.

*Material examined*.—Tokyo: Ikeda's type-material. Sendai: Specimens identified by Sato (#3–12). One recently collected specimen from Yaeyama Islands.

When Ikeda described this species he compared it to *S. funafuti* and said, “. . . *S. funafuti* is so peculiar in color and body form that it bears no resemblance to the present species in external aspects.” He also noted the absence of fixing muscles and the peculiar form of the papillae in *S. funafuti*. In the section on *S. funafuti* we comment on the fragile condition of those worms and dubious quality of fixing muscles as a distinguishing character. In Cutler and Cutler (1981) we comment on some morphological aspects of Ikeda's worms, e.g. true contractile vessel villi are not present, and draw attention to the similarity with *S. funafuti*.

Despite Ikeda's thought that these species differ in external color and form (see Cutler and Cutler 1981:53–55 for more comments on this point), we conclude that they are conspecific and despite the fact that Ikeda's description is a better one, must regrettably submerge *S. amamiense* as a junior synonym of *S. funafuti*.

*Siphonosoma (Siphonosoma) arcassonense* (Cuenot, 1902)

*Sipunculus arcassonense* Cuenot, 1902:15, pl. 1, figs. 15; 1922:1314, figs. 7a and 7b.

*Siphonosoma arcassonense*.—Saiz Salinas, 1980:9092, fig. 24.

*Material examined*.—Two specimens recently collected from type-locality: Arcachon, France. Nancy: Undissected specimen from Cuenot's material.

Cuenot's type had been reported to be in the Paris Museum but was located at the Université de Nancy, France. In his unpublished Master's thesis, Saiz Salinas described several more specimens from the type-locality. He stated that his worms have four fusiform bodies at the extreme posterior end of the trunk but are difficult to see because of the coagulation of the coelomocytes. He also said contractile vessel villi are present but does not describe them in any detail.

The 240 mm paratype (?), a 150-mm specimen Saiz Salinas loaned us, and a 135-mm worm sent by C. Cazaux, have very many, crowded, well-developed digitiform or shorter clavate villi arranged along most of the contractile vessel. The three or four, thin, pale tubular fusiform bodies are about 4–7 mm long and



more delicate than those in *S. ingens*. Each of the specimens we examined has the posterior tip of the trunk drawn in by 2–3 mm and the ventral nerve cord gives off numerous large, transverse nerves forming a plexus near the posterior end. The scalelike ‘hooks’ are arranged in up to 120 rings and are strikingly similar to *S. dayi*, i.e., tubular, attached to the skin except for the very tip and lacking a sharp point (Fig. 1A). This active burrower occurs sympatrically with *Sipunculus nudus* on beaches at Arcachon, France, but is rare.

We do not propose any change in the status of this peculiar and localized species.

*Siphonosom (Siphonosoma) australe* (Keferstein, 1865)

*Siphonosoma australe*.—Halder, 1976:3.—Cutler, 1977:139.—Cutler and Cutler, 1979:949. (See Stephen and Edmonds (1972) for synonymy prior to 1965).

*Material examined*.—London: Baird’s type of *S. aeneus*. Sendai: Sato’s type of *S. takatsukii* (Yap 6). Numerous specimens recently collected from the Indian Ocean.

Keferstein’s specimens cannot be located but this is a well known, widely reported, and valid species.

*Siphonosoma (Siphonosoma) boholense*  
(Selenka, De Man and Bulow, 1883)

*Sipunculus boholensis* Selenka *et al.*, 1883:109–111, pl. 12, figs. 175–177.—Fischer, 1895:5–6.—Lanchester, 1905b:27.

*Siphonosoma boholense*.—Edmonds, 1980:17.

*Material examined*.—Berlin: Selenka’s type (#988). Hamburg: Fischer’s specimen from Bohol (V 2050).

This species has been described in recent years as having contractile vessel villi, e.g. “. . . with numerous very small villi, appears bushy” (Edmonds 1980: 17). Stephen and Edmonds’ (1972:63) translation of Selenka’s description says, “. . . with many tubules.” Selenka’s words (1883:110) are “mit zahlreichen braunrothen Blindsackchen besetzt.” The term commonly used in German for villi is ‘zotten’ and the Blindsackchen which translates as ‘little caecae,’ suggests something different. As discussed in the introduction, there has been confusion here. True villi are digitiform, longer than broad and quite distinct, well-defined structures. However, in some worms lacking villi, the contractile vessel is large and exhibits bulbous vesicular or bubble-like swellings on the surface. When we examined Selenka’s types we saw only a bulbous or pleated vessel. Fischer’s worm in Hamburg shows no villi (he made no reference to any in his paper). Stephen and Edmonds (1972:63) reported re-examining two specimens from North Borneo in the British Museum. They made no reference to villi; we saw none either.

So, if this species lacks contractile vessel villi and hooks and has its retractor origins at different levels, it is similar to *S. amamiense* and *S. funafuti*. These two species are said to have fewer than 20 longitudinal muscle bands while *S. boholense* has 29–33. We would point out that only 10 specimens have been named *S. boholense* in the last 100 years and that none of these is less than 200

mm long. This raises the question: are these worms a distinct species or only an older, larger subset of a population which also includes *S. amamiense* and *S. funafuti*? In other words, do small *S. bohollense* really have 29–33 longitudinal muscle bands or have these bands split as the size increased, in a few older worms?

We seem to have in these three species two ends of a continuum with organisms having trunk lengths between 120 and 200 mm unrepresented in the collections. While we are inclined to consider these taxa as conspecific, we will postpone such a decision. We anticipate, however, that intermediate sized specimens can be found which will have 20–30 longitudinal muscle bands and thereby connect these two subsets. Also, histological and biochemical work may solve our uncertainty.

*Siphonosoma (Siphonosoma) bonhourei* (Herubel, 1904)

*Sipunculus bonhourei* Herubel, 1904:479–480; 1907:137–141, figs. 30–34.

*Material examined*.—None.

This species is known from only a single specimen which cannot be located. Herubel's description is long and detailed but it is unclear whether or not he had an entire worm. The origin of retractor muscles at the beginning of the posterior third of the trunk and the ratio of introvert to trunk (80 mm to 140 mm trunk) make one suspicious. Herubel also says that the introvert is 1/7 the trunk length.

There are other unclear issues such as the contractile vessel with short lateral ramifications or digitations (Herubel does not illustrate villi). This is in the complex which includes *S. amamiense*, *S. funafuti*, and *S. joubini*. In view of the uncertainties and loss of the type-specimen, it seems most prudent to place this species in *incertae sedis*.

*Siphonosoma (Siphonosoma) dayi* Stephen, 1942

*Siphonosoma dayi* Stephen, 1942:246–247, pl. 11, figs. 1–2.—Wesenberg-Lund, 1963:103, fig. 1.

*Material examined*.—Edinburgh: Stephen's type #1958.23.1.

Only three specimens have been given this name (one by Stephen and two by Wesenberg-Lund) but it does seem to be unique, if rare and geographically restricted. The unique feature is its introvert papillae which are well illustrated by both authors and referred to as scalelike bodies/structures or simply scales. One fact not mentioned is that the entire unit is fixed to the skin, not only basally as is a hook. There also appears to be an open pore at one end. It is easy to suppose that these are homologous to hooks and that their development became modified in some way. It may well be that we see here an example of an intermediate stage in the development of the *S. australe* type of hooks or perhaps a neotenous form. *Siphonosoma australe* is a common sympatric species so these three worms may simply be a few anomalous individuals. More data are needed to determine whether or not these really represent a biological population.

For the present we propose no change in status but point to its similarity to *S. australe*.



*Siphonosoma (Siphonosoma) eniwetoki* Fisher, 1950

*Siphonosoma eniwetoki* Fisher, 1950:805–808, pl. 1.

*Material examined*.—Washington, D.C.: Fisher's type #21128, plus bottle of 7 specimens (#24603) from Likiep Atoll, Marshall Islands; 12/13/51; identified by Fisher but unpublished.

These worms have distinctive introvert hooks. As drawn by Fisher they are closely associated with large papillae, but when the skin is stretched as in an expanded worm, the height of the papillae decreases. The apparent shape of the hook is dependent upon the angle at which one views the hooks (Fig. 1D). The sharpness or bluntness of the point can be misleading. The contractile vessel villi are digitiform or clavate but distinct even if small. They seem to be present along only the free part of the esophagus.

When Fisher described this species, *S. rotumanum* was still thought to lack hooks. This error was corrected by Edmonds (1971). As a result, Fisher did not compare his worms with *S. rotumanum*. But, with our correct understanding of this taxon, a comparison of these forms shows them to be conspecific. As *S. rotumanum* (Shibley, 1898) is the older name, *S. eniwetoki* becomes a junior synonym of that species.

*Siphonosoma (Siphonosoma) funafuti* (Shibley, 1898)

*Sipunculus funafuti* Shibley, 1898:469, pl. 37, figs. 4–5.

*Material examined*.—London: Shibley's paratype, 1 specimen. Hamburg: Shibley's type (?), 4 specimens.

These five worms all seem to have been identified by Shibley but the issue of holotype/paratype/cotypes is unclear. As noted by Stephen and Edmonds (1972: 65), "The body wall is thin and the internal structures very fragile." None of these has villi on its contractile vessel. The one in London does exhibit bulbous vesicles which have been interpreted as villi by some biologists. The alleged difference noted by Stephen and Edmonds (1972) between this species and *S. amamiense* is the number of intestinal fixing muscles (0 vs. 2). In previously dissected material it is impossible to say with certainty that such fragile structures were never present. The taxonomic significance of this character is doubtful even if it were actually absent and not just overlooked or inadvertently broken.

We conclude that *S. funafuti* is a valid species, conspecific with, and a senior synonym of *S. amamiense*.

*Siphonosoma (Siphonosoma) ingens* (Fisher, 1947)

*Siphonomecus ingens* Fisher, 1947:365–368, pl. 14, 15.

*Siphonosoma ingens* Fisher, 1952:382–385, pl. 20, 21.

*Material examined*.—Washington, D.C.: Fisher's type (#20910).

This species with fusiform bodies, contractile vessel villi and without introvert hooks remains a valid species. It is very similar to *S. mourense* (Sato) except for the presence of the peculiar fusiform bodies (Fig. 1I). Preliminary histological examination of these bodies suggests an excretory function.

*Siphonosoma (Siphonosoma) joubini* (Herubel, 1905)

*Sipunculus joubini* Herubel, 1905:51–54, 3 figs; 1907:141–145, figs. 35–37.

*Material examined*.—None.

The single worm Herubel described cannot be located and no one else has reported such an animal in the intervening 77 years. Herubel's (1907) Fig. 37 shows a rather unique contractile vessel with a few small caecum-like structures (digitations), not normal villi. Whether this animal represents a population or simply a single anomolous individual is uncertain but the fact that in the many Indo-West Pacific collections, no other specimens have appeared, makes the latter case probable.

In view of the above facts we propose placing this species on the list of *incertae sedis*.

*Siphonosoma (Siphonosoma) mourense* Sato, 1930

*Siphonosoma mourense* Sato, 1930:6–8, pl. 1, figs. 2–4; 1937:148–149, pl. 3, fig. 9; 1939:370–371.—Leroy, 1936:425.

*Material examined*.—Sendai: Sato's type-material (#183, 3 specimens) plus others identified by Sato.

This species was discussed in Cutler and Cutler (1981) and at that time considered to be a valid species. It is similar to *S. cumanense* except that the retractor muscles originate at different levels and there are no transverse dissepiments. It is also very similar to *S. ingens* except that this latter species has the peculiar and easily overlooked fusiform bodies at the posterior end of the trunk. An examination of Sato's worms did not show fusiform bodies to be present. *Siphonosoma moursense* and *S. ingens* are closely related, both occurring in the North Pacific.

*Siphonosoma (Siphonosoma) novaepommeraniae* (Fischer, 1926)

*Sipunculus novaepommeraniae* Fischer, 1926:104–106, pl. 3, figs. 2–4, 6.

*Siphonosoma novaepommeraniae*.—Wesenberg-Lund, 1959:55–58, text-figs. 1–3.—Murina, 1967:1338.—Edmonds, 1971:140–141; 1980:17.—Cutler, 1977:139.

*Material examined*.—Hamburg: Fischer's type (#V3414). Copenhagen: Wesenberg-Lund's specimens from Mauritius.

In Cutler and Cutler (1979:948) in an analysis of transverse dissepiments in *Siphonosoma cumanense*, it was observed that “. . . *S. novaepommeraniae* is exactly like *S. cumanense* except it lacks the transverse dissepiments. Wesenberg-Lund (1959) says they exist in her Mauritius forms of *S. novaepommeraniae* and even draws them. Hers then should be considered *S. cumanense* and possibly Fischer's (1926) should be here also.”

Our examination of Wesenberg-Lund's worms reinforced this conclusion. Fischer's single worm did not exhibit these structures but as shown in Cutler and Cutler (1979) this character is not consistently present in a population and should not be weighed very heavily. Like Fischer, the records of Murina (1967) and Edmonds (1980) are single individuals. It is our conclusion that *S. cumanense* is



a common, circumtropical species which includes some specimens with and some without transverse dissepiments and that when certain careful observers noticed their absence, a different name was applied. However, we propose that this distinction is taxonomically meaningless and *S. novaepommeraniae* should be treated as a junior synonym of *S. cumanense*.

*Siphonosoma (Siphonosoma) pellucidum* (Sluiter, 1902)

*Sipunculus pellucidus* Sluiter, 1902:9–10, pl. 1, fig. 3.

*Material examined*.—Amsterdam: Sluiter's type (V.Si. 168.7), 2 spec.; (V.Si. 168.8), 3 spec.

These five worms range in trunk length from 12–20 mm. They were not shifted from *Sipunculus* to *Siphonosoma* until Stephen and Edmonds (1972): "A re-examination of one of Sluiter's specimens (not marked as type) shows that the species is a *Siphonosoma*. . . . The introvert is not strongly marked from the trunk, it lacks the triangular, squamiform papillae of a *Sipunculus* and there are no hooks or spines."

The small size clearly shows these to be juvenile worms, as does their semi-transparent, thin body wall. They appeared to us to strongly resemble young *Sipunculus* species. The development of muscle bands, both longitudinal and circular as well as introvert papillae may well occur later in their ontogeny. If these are truly *Siphonosoma*, they are the only ones lacking villi and hooks, and which have the retractor origins at the same level.

We propose that one cannot make a definite assignment on the basis of this material but favor the original placement in the genus *Sipunculus*. However, due to their condition and small size, it seems best to place this taxon in *species inquirendum* pending future clarification.

*Siphonosoma (Siphonosoma) pescadolense* Sato, 1939

*Siphonosoma pescadolense* Sato, 1939:376–379, pl. 20, fig. 8, text-figs. 18–22.

*Material examined*.—None.

Cutler and Cutler (1981) synonymized this species with Sato's species, *S. takatsukii*, and made the latter a subspecies of *Siphonosoma australe*. We reaffirm that action.

*Siphonosoma (Siphonosoma) rotumanum* (Shipley, 1898)

*Sipunculus rotumanus* Shipley, 1898:469–470, pl. 37, figs. 1–3.

*Siphonosoma rotumanum*.—Edmonds, 1971:143–144; 1980:18; Christie & Cutler, 1974:109–110.—Gibbs, 1978:85.

*Siphonosoma hawaiiense* Edmonds, 1966:386–388, figs. 1–4.

*Material examined*.—London: 1 specimen identified by Shipley, possible type. Hamburg: 1 specimen identified by Shipley; possible cotype (V5391).

When Shipley described this species he misinterpreted the unique introvert hooks/spines which are present by referring to them as papillae. This oversight which created problems for Edmonds (1971) also caused Fisher (1950) to bypass this species when he named *S. eniwetoki* (as noted earlier in this paper). The

peculiar introvert hooks and associated papillae can vary somewhat in apparent form in different states of contraction or when viewed from different angles. This species name remains valid as redescribed by Edmonds.

*Siphonosoma (Siphonosoma) takatsukii* Sato, 1935

*Siphonosoma takatsukii* Sato, 1935:308–310, pl. 3, fig. 8, text-figs. 8–10; 1939: 373.

*Material examined*.—Sendai: Sato’s type-specimen.

Cutler and Cutler (1981) reduced this to a subspecies of *Siphonosoma australe*. There is only one specimen and it differs from *S. australe* in having smaller, blunter hooks, and being restricted to the northeast Pacific Ocean. That conclusion is reaffirmed.

Known Distribution of *Siphonosoma* Species

Only three of these ten species have been recorded from a broad area; the remaining seven apparently have a much more restricted range as follows:

<i>S. arcassonense</i>	Western France
<i>S. ingens</i>	Southern California
<i>S. mourense</i>	Northeast Honshu, Japan
<i>S. dayi</i>	Natal, South Africa
<i>S. boholense</i>	Queensland, Australia, and North Borneo
<i>S. funafuti</i>	Southern Japanese Islands, and Funafuti
<i>S. rotumanum</i>	Hawaii to Queensland, and Cape Province, South Africa
<i>S. vastum</i>	Indo-West Pacific—tropical
<i>S. australe</i>	Indo-West Pacific—tropical and subtropical
<i>S. cumanense</i>	All oceans, tropical and subtropical (not recorded from the eastern Atlantic and eastern Pacific Oceans)

The first two species have a very restricted distribution, are separated by thousands of miles from other *Siphonosoma*, and are in the only regions unoccupied by *S. cumanense*. They are also the only two with posterior fusiform bodies.

Key to *Siphonosoma* Species

1. Contractile vessel without distinct villi (bulbous vesicles may be present)  
..... 2
- Contractile vessel bears distinct villi ..... 6
2. Introvert with hooks or scalelike papillae ..... 3
- Introvert without hooks or scalelike papillae ..... 5
3. Introvert with rings of tubular scalelike papillae, not free standing hooks  
..... *S. dayi*
- Introvert with distinct hooks ..... 4
4. Rectum with numerous caecae/diverticula ..... *S. vastum*
- Rectum without numerous caecae/diverticula ..... *S. australe*
5. Less than 22 longitudinal muscle bands ..... *S. funafuti*
- More than 28 longitudinal muscle bands ..... *S. boholense*



- 6. Introvert with rings of hooks or scalelike papillae ..... 7
- Introvert without hooks or scalelike papillae ..... 8
- 7. Scalelike chitinated papillae on introvert; posterior end of trunk with internal fusiform bodies ..... *S. arcassonense*
- Short, blunt hooks on introvert; no fusiform bodies ..... *S. rotumanum*
- 8. Retractor muscles originate at same level ..... *S. cumanense*
- Dorsal retractor muscles originate anterior to the ventral pair ..... 9
- 9. Fusiform bodies in posterior end of trunk ..... *S. ingens*
- Fusiform bodies absent ..... *S. mourense*

### Acknowledgments

This work was made possible with the cooperation of the following persons who made specimens available to us: H. Terayama, University Zoological Museum, Tokyo; Z. Kawabata, Tohoku University, Zoological Institute, Sendai; S. van der Spoel, Instituut voor Taxonomische Zoölogie, Amsterdam; J. Renaud Mornant, Muséum National d'Histoire Naturelle, Paris; G. Hartwich, Museum für Naturkunde, Berlin, DDR; M. Dzwillo, Universität Zoologisches Museum, Hamburg; J. B. Kirkegaard, University Zoological Museum, Copenhagen; S. Chambers, Royal Scottish Museum, Edinburgh; R. W. Sims, British Museum, (Natural History), London; M. Jones, National Museum of Natural History, Washington, D.C.; J. Saiz Salinas, Bilboa, Spain; C. Cazaux, Station Biologique D'Arcachon, France; B. Conde, Université de Nancy, France. The helpful comments and suggestions of P. Gibbs, Plymouth, are gratefully acknowledged. A draft of this paper was read by T. Nishikawa (Nagoya) and S. Edmonds (Ade-laide). This work was supported by a grant from the U.S. National Science Foundation (DEB 8011121).

### Literature Cited

- Augener, H. 1903. Beiträge zur Kenntnis der Gephyreen nach Untersuchung der im Gottinger zoologischen Museum befindlichen Sipunculiden und Echiuriden.—Archiv für Naturgeschichte 69:297–371.
- Christie, N. D., and E. B. Cutler. 1974. New distribution records for two species of *Siphonosome* (Sipuncula) collected using a diver-operated suction sampler.—Transactions of the Royal Society of South Africa 41(2):109–110.
- Cuenot, L. 1902. Contributions à la faune du bassin d'Arcachon Echiuriens et Sipunculien.—Bulletin de l'Société du Science, Arcachon 1902:1–28.
- . 1922. Sipunculien, Echiuriens, Priapulien.—Faune de France, Paris 4:1–30.
- Cutler, E. B. 1977. The bathyal and abyssal Sipuncula.—Galathea Report 14:135–156.
- . Proposed conservation of *Siphonosome cumanense* (Keferstein, 1867) over *S. edule* Pallas, 1774 (Sipuncula).—International Commission of Zoological Nomenclature. (in press)
- Cutler, E. B., and N. J. Cutler. 1979. Madagascar and Indian Ocean Sipuncula.—Bulletin of the American Museum of Natural History 4:941–990.
- , and ———. 1981. A reconsideration of Sipuncula named by I. Ikeda and H. Sato.—Publications of the Seto Marine Biological Laboratory 26(1/3):51–93.
- Cutler, E. B., N. J. Cutler, and T. Nishikawa. *Siphonosome cumanense* and *S. edule* (Sipuncula): A reevaluation of their separate status.—Publications of the Seto Marine Biological Laboratory. (in press)
- Edmonds, S. J. 1955. Australian Sipunculoidea. I. The genera *Sipunculus*, *Xenosiphon*, and *Siphonosome*.—Australian Journal of Marine and Freshwater Research 6:82–97.
- . 1966. *Siphonosome hawaiiense*, a new sipunculoid from Hawaii (Sipunculoidea).—Pacific Science 20(3):386–388.

- . 1971. Some sipunculans and echiurans, chiefly from Guam (Sipuncula and Echiura).—*Micronesica* 7(1-2):137-151.
- . 1980. A revision of the systematics of Australian sipunculans (Sipuncula).—*Records of the South Australian Museum* 18(1):1-74.
- Fischer, W. 1895. Die Gephyreen des Naturhistorischen Museums zu Hamburg.—*Abhandlungen aus dem Gebiet der Naturwissenschaften*, Hamburg 13:1-24.
- . 1919. Gephyreen der Süd-westküste Australiens.—*Zoologischer Anzeiger* 50:277-285.
- . 1926. Sipunculiden und Echiuriden der Hamberger Susee-Expedition 1908-1909.—*Mitteilungen aus dem Zoologischen Staatsinstitute und Zoologischen Museum in Hamburg* 42:104-117.
- . 1927. Sipunculoidea und Echiuroidea.—*Fauna Südwest-Australiens*, herausgeben von W. Michaelsen 5:199-216.
- . 1928. II. Über zwei neue *Siphonosoma*—Arten der Wurtembergischen naturalien Sammlung zu Stuttgart.—*Zoologischer Anzeiger* 76:138-143.
- Fisher, W. K. 1947. New genera and species of Echiuridae and Sipunculid worms.—*Proceedings of the United States National Museum* 97:351-372.
- . 1950. Two new subgenera and a new species of *Siphonosoma* (Sipunculoidea).—*Annals and Magazine of Natural History*, series 12, 3:805-808.
- . 1952. The sipunculid worms of California and Baja California.—*Proceedings of the United States National Museum* 102:371-450.
- Gibbs, P. E. 1978. Macrofauna of the intertidal sand flats on low wooded islands, northern Great Barrier Reef.—*Philosophical Transactions of the Royal Society of London*, B 284:81-97.
- Halder, B. P. 1975. Sipuncula of the Indian Ocean in the collection of the Zoological Survey of India. In M. E. Rice and M. Todorovic (eds.), *Proceedings of the International Symposium on the Biology of Sipuncula and Echiura* 1:51-92.
- . 1976. Sipuncula from the Andaman and Nicobar Islands.—*Records of the Zoological Survey of India* 70:1-9.
- Herubel, M. 1904. Sur les Sipunculides nouveaux rapportes de la mer Rouge, par M. Cu. Gravier (note préliminaire).—*Bulletin du Muséum National D'Histoire Naturelle*, Paris, 10:476-480.
- . 1905. Sur un nouveau siponcle de la collection du Muséum (*Sipunculus joubini* sp. nov).—*Bulletin du Muséum National D'Histoire Naturelle*, Paris 11:51-54.
- . 1907. Recherches sur les Sipunculides.—*Mémoires de la Société Zoologique de France* 20:107-418.
- Ikeda, I. 1904. The Gephyrea of Japan. *Journal of the College of Science, Imperial University of Tokyo* 20(4):1-87.
- . 1924. 2. Further notes on the Gephyrea of Japan, with descriptions of some new species from the Marshall, Caroline, and Palau Islands.—*Japanese Journal of Zoology* 1:23-44.
- Keferstein, W. 1865. Beiträge zur anatomischen und systematischen Kenntniss der Sipunculiden.—*Zeitschrift für Wissenschaftliche Zoologie* 15:404-445.
- . 1867. Untersuchungen über einige amerikanische Sipunculiden.—*Zeitschrift für Wissenschaftliche Zoologie* 17:44-55.
- Lanchester, W. F. 1905a. Gephyrea in the marine fauna of Zanzibar and British East Africa from the collections made by C. Crossland in 1901-02.—*Proceedings of the Zoological Society of London* 1:28-35.
- . 1905b. On a collection of sipunculids made at Singapore and Malacca.—*Proceedings of the Zoological Society of London* 1:26-28.
- Leroy, P. 1936. Les sipunculiens du Muséum d'Histoire Naturelle de Paris.—*Bulletin du Muséum National D'Histoire Naturelle*, Paris, serie 2, 8:423-426.
- Murina, V. V. 1967. Report on the sipunculid worms from the sublittoral zone of Cuba and Mexican Gulf.—*Zoologicheskii Zhurnal* 54(9):1329-1339.
- . 1981. First report of the sea worms Sipuncula and Echiura from littoral Somali.—*Vesnik Zoology* 1:11-18.
- Nishikawa, T. 1977. Sipuncula.—*Nature Study* 23(4):47-48. (in Japanese)
- Pallas, P. S. 1774. Lumbricus.—*Spicilegia Zoologica* 10:1-15.
- Saiz Salinas, J. I. 1980. Estudio de los sipunculoides (Sipuncula) de los fondos litorales y circalitorales de las costas de la península Iberica, Islas Baleares, Canarias y mares Adyacentes.—Departamento Biología, Universidad del Pais Vasco, 120 pp. (unpublished thesis)



- Sato, H. 1930. Report on the biological survey of Mutsu Bay. 15. Sipunculoidea.—Scientific Reports, Tohoku University, series 4, 5:1–40.
- . 1935. Sipunculoidea and Echiuroidea of the West Caroline Islands. Scientific Reports, Tohoku University, series 4, 10:299–329.
- . 1937. Echiuroidea, Sipunculoidea, and Priapulidea obtained in northeast Honshu, Japan.—Research Bulletin, Saito Ho-on Kai Museum 12:137–176.
- . 1939. Studies on the Echiuridae, Sipunculids, and Priapulids of Japan.—Scientific Reports Tohoku University, series 4, 14:339–459.
- Selenka, E., J. G. De Man, and C. Bulow. 1883. Die Sipunculiden, eine systematische Monographie.—Reisen im Archipel Philippinen von Dr. C. Semper, Part 2, 4:1–131.
- Shiple, A. E. 1898. Report on the Gephyrean worms collected by Mr. J. Stanley Gardiner at Rotuma and Funafuti.—Proceedings of the Zoological Society of London 1898:468–473.
- . 1899. Notes on a collection of gephyrean worms found at Christmas Islands, Indian Ocean, by Mr. C. W. Andrews.—Proceedings of the Zoological Society of London 1899:54–57.
- . 1902. Sipunculoidea, with an account of a new genus *Lithacrosiphon*. In J. S. Gardiner, ed. Fauna and Geography of the Maldives and Laccadive Archipelagoes 1:131–140.
- Sluiter, C. Ph. 1882. Beiträge zu der Kenntniss der Gephyreen aus dem Malayischen Archipel.—Natuurkundig Tijdschrift Nederlandisch-Indie 41:148–171.
- . 1886. Beiträge zu der Kenntnis der Gephyreen aus dem Malayischen Archipel.—Natuurkundig Tijdschrift Nederlandse-Indie 45:472–517.
- . 1891. Die Evertrebraten aus der Sammlung des königlichen naturwissenschaftlichen Vereins in niederländische Indien in Batavia. III. Die Gephyreen.—Natuurkundig Tijdschrift Nederlandisch-Indie 50:102–123.
- . 1902. Die Sipunculiden und Echiuriden der “Siboga” Expedition. Siboga Expeditie Monographie 25:1–53.
- Spengel, L. W. 1912. Einige Organisationsverhältnisse von Sipunculusarten und ihre Bedeutung für die Systematik dieser Tiere.—Verhandlungen Deutsche Zoologische Gesellschaft 22:261–272.
- Stephen, A. C. 1941. Sipunculids and Echiurids of the John Murray Expedition to the Red Sea and Indian Ocean 1933–34.—Scientific Reports, John Murray Expedition 7:401–409.
- . 1942. The South African Intertidal zone and its relation to ocean currents. Notes on the intertidal sipunculids of Cape Province and Natal.—Annals of the Natal Museum 10:245–256.
- . 1960. Echiuroidea and Sipunculoidea from Senegal, West Africa.—Bulletin de l'Institut Français d'Afrique Noire 22, ser. A (2):512–520.
- Stephen, A. C., and S. J. Edmonds. 1972. The Phyla Sipuncula and Echiura.—London: British Museum (Natural History). 528 pp.
- Wesenberg-Lund, E. 1937. Gephyrea.—Bulletin Musée Royal d'Histoire Naturelle de Belgique 13(36):1–23.
- . 1959. Sipunculids and Echiuridae from Mauritius.—Videnskabelige Meddelelser Danske fra Naturhistorisk Forening i Kjobenhavn 121:53–73.
- . 1963. South African Sipunculids and Echiuroids from coastal waters.—Videnskabelige Meddelelser Danske fra Naturhistorisk Forening i Kjobenhavn 125:101–146.

Utica College of Syracuse University, Utica, New York 13502, U.S.A.